Pain Symptoms and Self-Reported Physical Function in Older, Overweight and Obese Knee Osteoarthritis Patients

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Abstract

Knee osteoarthritis (OA) is one of the leading causes of chronic pain, functional limitation, and physical disability among older adults. Being overweight or obese may exacerbate pain symptoms and the risk of functional decline among knee OA patients (5, 7, 14). However, it has yet to be determined if risk of functional decline and inactivity differs as a function of weight status among older, knee OA patients. *PURPOSE***:** The purpose of this investigation was to examine differences in self-reported pain symptoms and physical function among overweight, obese, and morbidly obese older adults with knee OA. *METHODS***:** Seventy-one (58 women and 13 men; *M* age = 63 years) knee OA patients classified as overweight (n=21), obese (n=36) or morbidly obese (n=14) completed assessments of the Western Ontario and McMaster Universities (WOMAC) Osteoarthritis scale. *RESULTS:* Results of univariate ANCOVA analyses controlling for age revealed that morbidly obese participants reported worse pain ($p < 0.01$) and greater functional disability ($p < 0.01$) when compared with overweight and obese counterparts. No significant differences were observed for pain or functional disability, between participants classified as obese or overweight. *CONCLUSIONS:* These findings suggest that pain and risk for physical disability increases as a function of weight status among older knee OA patients. Morbidly obese patients demonstrated the least favorable pain outcomes and greatest functional disability. Collectively, the present findings indicate the benefits of lower weight for both mobility self-efficacy and objective functional performance among older adults with knee OA.

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Background

This project was completed in conjunction with the Improving Maintenance of Physical Activity in Osteoarthritis Trial – Pilot (IMPACT – P) study being conducted by Brian Focht, PhD. The study examines the effectiveness of two different exercise interventions for older adults diagnosed with knee OA and is funded by the NIH/NIAMS.

Data for this investigation came from baseline evaluation of 71 participants diagnosed with mild to moderate radiographic knee OA. Body Mass Index (BMI) was determined from objective measurements of height and weight. Scores from the WOMAC scale determined pain and functional disability. The LifeCorder EX Accelerometer measured a participant's level of physical activity.

Introduction

Knee Osteoarthritis (OA) is a chronic, debilitating disease affecting millions of people nationwide (6). The CDC reports that 4.3 million people over the age of 60 have symptomatic knee OA. Knee OA is one of the five leading causes of disability in adults (6). Clinical symptoms include increased pain in the affected joint, decreased physical functioning, and greater difficulty performing activities of daily living (10, 12**)**. Pain is one of the most commonly reported clinical symptoms and indicators of knee osteoarthritis. Osteoarthritis is not limited to only the knee joint, it can affect any joint in the body (1). Despite the fact that osteoarthritis can occur in any joint, knee OA is of great clinical importance due to the weight bearing nature of the joint. It therefore, is crucial to examine the onset and progression of the disease in order to prevent the functional decline associated with the disease.

Due to the location at the anterior segment of the leg and the related physical action (i.e., knee extension) weakness in the quadriceps muscle group has been implicated in the

pathogenesis and progression of knee osteoarthritis. Along these lines, research has shown that quadriceps strength was indeed decreased in those with knee osteoarthritis (10, 13). Obese persons are known to have greater absolute muscle strength due to carrying around the extra bulk associated with increased adiposity and corresponding weight (5). It might be assumed that their higher absolute strength could serve as a protective mechanism. On the contrary, research has shown that those with knee osteoarthritis tend to be heavier than those without the disease (5) and population descriptors from Marks indicated that as much as 80% of the OA population had a BMI greater than 25 (11). Rather than absolute muscle strength, research appears to indicate that strength relative to body mass may be more indicative of disease development and course of action (5, 7, 14). Despite an increased quantity of muscle, a higher BMI does not necessarily protect from knee OA development or progression, but might actually increase the risk for onset and advancement.

Research illustrated that pain symptoms are the primary cause of physical activity restriction in older adults (8). As a result, pain can lead to a vicious cycle of inactivity and muscle atrophy. Through activity restriction, the patient limits the painful stimulus from his or her daily activities, thus decreasing activity levels may hasten the muscle wasting process. The question then arises with overweight and obese individuals generally being more inactive than their healthy weight counterpart are they more susceptible to the debilitating pain of knee OA and the accompanying functional decline?

Research has implicated obesity in the development and progression of the disease (4, 5, 11). Some researchers have gone as far to say that obesity is the number one preventative risk factor for knee osteoarthritis (4). This is underscored by research conducted by Ray Marks. Data indicated that BMI was positively correlated with pain symptoms, and as the BMI of individuals

increased so did self-reported pain symptoms (11). This might be explained by the additional weight placed on the knee joint. In a normal gait pattern, a force of three times your body weight is exerted on your knee during the single-leg stance phase of walking (3). Extra weight might negatively impact the cartilage and result in more severe, debilitating knee pain.

In addition to the pain and functional limitations associated with knee OA, research has shown that obese knee OA patients have a lower self-reported quality of life than healthy weight population norms (2). Quality of life includes factors such pain and functional limitations. The higher the reported values, the lower a person's quality of life is said to be. Interestingly, not only obese knee OA patients report a lower quality of life but also obese patients without a history of knee OA reported a lower quality of life (2). Additionally, a higher BMI is associated with an increase in walking limitations (15) and an increase in sedentary activities (**7**), leading to the vicious cycle of inactivity, decreased muscle strength, and increased pain and limitations.

Joint pain and increasing functional disability are debilitating symptoms of knee OA. This knowledge, coupled with knowing that decreased relative muscle strength and obesity are implicated in the development and progression of knee OA, the primary focus of this investigation is to examine the relationship between weight status and self-reported pain symptoms and function limitations in those with mild to moderate knee OA.

Subjects and Methods

Participants were recruited from The Ohio State University Medical Center and The Ohio State University Institutional Review Board approved the IMPACT study. Inclusion criteria consisted of male or female participants fifty-five years or older who have documented mild to moderate tibiofemoral knee osteoarthritis with pain symptoms on most days of the week and difficulty performing at least one activity of daily living due to the associated knee pain.

Potential participants were called to gauge interest in the study and to check that all inclusion criteria were met. Those currently engaged in structured physical activity programs for more than 20 minutes per week were excluded. Once enrolled and consented, participants were scheduled for a baseline evaluation which occurred in the Physical Activity and Educational Services.

During the baseline evaluation, measurement of pain and physical functioning was determined via self-report of each measure by using the Western Ontario and McMaster Universities (WOMAC) Osteoarthritis scale. Subjects answer questions related to their daily activities, how they are limited in their daily activities and pain symptoms. Subjects rate their pain or limitation on a scale from zero, indicating no pain or limitation, to four, indicating extreme pain or limitation. Answers are based on how the participants felt in the past 48 hours. The physical function subscale consists of 17 items each scored from zero to four points for a total of 68 points. The pain subscale consists of five questions each scored from zero to twenty for a total of 20 points. Higher scores on both subscales indicate worse function and pain.

Body Mass Index (BMI) was calculated based on objectively measured height and weight. Values, initially recorded in inches and pounds, were then converted to their metric component in order to obtain the proper value of kg/m^2 for BMI.

The LIFECORDER Plus EX activity monitor provided an objective measurement of physical activity levels. Participants wore the activity monitor for a seven-day period to measure total levels of physical activity participation. The activity monitor was then mailed back to the university, along with a daily log indicating how long the device was worn each day and when and why it was removed.

Statistical Analysis

Results of the WOMAC were recorded and analyzed as their numerical component. An answer of zero received zero points and an answer of four received four points. SPSS Software, 19th edition, was used to run a univariate analysis of covariance controlling for age of participants.

Results

Seventy – one participants provided information for the study, 53 were women. Mean age was 63, with a standard deviation of 2.85. Sixty-six percent were Caucasian, 33% African American, 3% Asian, 1% Latino.

Weight Classification (BMI)	Number of Participants
Overweight (25 – 29.9)	21
Obese (30 – 39.9)	35
Morbidly Obese (>40)	14

Table 1: Distribution of weight classification

Results of a univariate ANCOVAs controlling for age revealed significant differences in the pain ($p < 0.000$) and physical function ($p < 0.001$) subscales of the WOMAC as a function of weight status. Those who were morbidly obese reported higher pain and physical disability than their overweight and obese counterparts. No significant difference was found between the overweight and obese classifications. Tables 2 and 3 illustrate this.

Weight Classification	Weight Classification	Significance (p)
Overweight	Obese	0.934
	Morbidly Obese	0.001
Obese	Overweight	0.934
	Morbidly Obese	0.000
Morbidly Obese	Overweight	0.001
	Obese	0.000

Table 2: Relationship between weight classification and reported pain.

Weight Classification	Weight Classification	Significance (p)
Overweight	Obese	0.502
	Morbidly Obese	0.004
Obese	Overweight	0.502
	Morbidly Obese	0.000
Morbidly Obese	Overweight	0.004
	Obese	0.000

Table 3: Relationship between weight classification and reported physical disability.

Cohen's d showed a similar pattern for effect size of functional limitations, with there being no significance between the overweight to obese group (d = 0.20) but a significant relationship between morbidly obese and overweight (d = 1.04) and morbidly obese and obese (d = 1.38). Effect size for pain showed a similar relationship for pain scores. The morbidly obese relationship with obese (d = 1.26) and with overweight (d = 1.16) showed the only clinical significance, there was no significance between overweight and obese (d = 0.20) individuals.

Finally, a correlation exists between physical functioning and pain and physical activity. Those who were less active (as measured by the person's total steps) experienced more pain and more functional disability than their more active counterparts.

Discussion

This study of 71 older, overweight and obese adults with knee OA accentuates the benefits of weight reduction and physical activity interventions in this population. Morbidly obese individuals showed the highest values for pain and functional limitations with no significant differences between those who are obese and overweight. All participants in this study had mild to moderate knee OA (Kellegren – Lawrence value ≤ 2), this should control for all the pain and limitation, however, a difference is still seen based on the individual's weight status.

These results are similar to results of other studies with older, obese and overweight knee osteoarthritis patients. Marks found that a higher BMI is associated with more pain (11).

Stenholm and colleagues also observed that weight classification was related to walking limitation. Twenty-eight percent of women and 21% of men who were classified as overweight showed walking limitations. By contrast, 58% of women and 46% of men who were classified as severely obese showed walking limitations (15). The Stenholm study did not specifically investigate knee OA patients. However, they did find, in women, that knee osteoarthritis was the largest contributor to the association between BMI and walking limitation (15).

Contrary to the results from this study, Marks study could not find a relationship between functional limitations and body mass (11). Marks examined at functional performance tests whereas the present study used self-report methods, this could explain the differing results. Self-report methods, while reliable, are subjective measures as compared to the objective measures of a six-minute walk test. Interestingly, the present study found a partial correlation between physical activity and pain and functional limitations, with physical activity showing an inverse relationship with pain and functioning. Those who recorded less physical activity tended to report higher pain levels and more functional difficulties.

The results underscore the benefits of weight reduction in obese and overweight knee OA patients. Previous studies have shown the benefit of weight reduction in those with knee OA to both lessen joint pain as well as increased walking ability (9). Huang and colleagues found that a correlation between weight loss and physical function and pain exist. Patients that lost 15% of their body weight would decrease their pain to a tolerable level. Similar results were obtained for physical function, a 12% decrease in body weight would lead to acceptable functioning (9).

Additionally, results from the present study indicate the need for a healthy lifestyle intervention, as opposed to an intervention focused solely on weight loss. Huang et al used a triple therapy intervention, with two of the components being diet and exercise. The exercise

could be helpful in decreasing the muscle atrophy associated with physical inactivity, thus helping to decrease the pain in knee OA patients.

All the patients in this study met WHO classifications as overweight, obese, or morbidly obese. A limitation of this study is the lack of healthy weight knee OA patients to compare to the overweight and obese groups. This study is unable to say that patients with a BMI of less than 25 have even less pain and functional limitations than those with higher BMIs. Further inquiry will assist in clarifying how body weight may influence the pathogenesis and advancement of the disease and its symptoms.

Conclusions/Implications

This study indicates that weight loss may be a beneficial treatment for the pain and functional limitations often seen in older adults with knee osteoarthritis. An intervention study showing weight loss over time with this population needs to be done to confirm this. Additional results indicate that a weight loss intervention with a physical activity component may be the best way to combat the increased pain symptoms and physical function limitations.

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